

***Observational Evidence of Aging Processes in Comets***

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***Strategy***

The emphasis of my NASA research is to search for systematic differences among two groups of comets: periodic comets which spend most of their time in the vicinity of the inner Solar System and the new comets which are believed to be passing through the inner Solar System for the first time. Such differences are expected, but have never been observed, in part because there has never been a systematic observational program aimed at addressing this question. Understanding possible physical and compositional differences between these two groups will lead to a better understanding of the cometary formation conditions in the early Solar System. The method employed in this investigation is to study the activity in the comets as a function of distance by obtaining CCD observations of the comets at frequent intervals on both the pre- and post-perihelion legs of their orbits in order to ascertain the distances at the onset and turn-off of activity through comparison with sublimation models.

***Progress and Accomplishments***

During the past year, there have been 8 successful observing runs (CCD imaging and photographic plates) totalling 34 nights using the University of Hawaii (UH) 2.2m, Kitt Peak (KPNO) Schmidt, and Cerro Tololo Interamerican Observatory (CTIO) 4m and Schmidt telescopes. The runs have produced 58 faint program comet observations at different heliocentric distances. Among these observations include probable recoveries of comets Grigg-Skjellerup and Giacobini-Zinner at large heliocentric distances. In addition, wide-field observations of comet plasma tails were obtained in a related study of the tails in both periodic and Oort comets. A third project was undertaken in 1991 January to search along the path of the Kreutz sungrazing comets to search for fragments of the progenitor cometary body in order to place constraints on the homogeneity of the nucleus, or on the size of the population of fragments in the orbit. A program of monitoring the activity in Chiron has intensified since the discovery of its cometary activity. Chiron has begun to show rapid short-term brightness fluctuations and in 1990 December began to develop a tail.

Monitoring of comet Halley has lead to the discovery of a large outburst in brightness at a heliocentric distance of 14.3 AU, approximately 1 year after the activity had ceased and it had reached its expected nuclear brightness.

Considerable progress has been made on the analysis of the extensive data set on the distant comets. However, approximately 3-5 days are required to reduce each night of observation because of the need for extremely accurate flattening in order to study to extent of comae and surface brightness profiles and structures in the distant, faint comets. Work is continuing in this area. The analysis of the Chiron data has shown considerable short term activity. In addition, the December observations showed the development of a tail.

### ***Projected Accomplishments***

Although continued coverage of the program comets will be high priority this year, the highest priority will be given to the reduction of the extensive data which has been accumulated to date, and the analysis of these observations. Astrometry of all of the year's comet observations will be kept up-to-date. Along these lines, I have undertaken a project to obtain the facilities necessary to perform the astrometry at the IFA. This program should be operational within a couple months. Continued monitoring of comet Halley is planned over the next few months to investigate the cause of the outburst activity.

### ***Publications***

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